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Long-term Results After Surgical Reconstruction for Renal Artery Fibromuscular Dysplasia

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Objectives: *to study the initial and long-term results of surgery for renal artery fibromuscular dysplasia (RFMD).*
Patients and Methods: *all patients undergoing renal artery reconstruction (RAR) performed for RFMD between January 1980 and December 1997, were studied. The preprocedural and postprocedural clinical records of 101 patients (80 women, 21 men; mean age at surgery 43 years) were retrospectively reviewed. All surviving patients were invited for clinical reexamination and colour-coded duplex-ultrasound of the renal arteries (RA).*
Results: *initial technical success was achieved in 83 of 93 patients (89%), in whom postoperative angiography (90) or renal scintigraphy (three) were performed for assessment of RAR. Early occlusion (four) or stenosis (one) demanded reoperation in five patients (5%). The 30-day mortality and morbidity were 2% and 12% for the entire group. Primary patency rate was 74% at 5 years. Fifteen patients had to be reoperated for restenosis after a mean time of 33 months, resulting in a secondary patency rate of 85% after 5 years. In 61 patients with patent RAR at the time of re-examination, arterial hypertension was cured only in 22 (36%) and improvement in 19 (31%).*
Conclusion: *vascular surgery for RFMD yields good long-term results as to kidney perfusion and function. Surveillance of RAR-patency by means of ultrasound examination is mandatory in case of recurrence of arterial hypertension or deterioration. Rates of cure of hypertension are disappointing.*

Key Words: Fibromuscular dysplasia; Renal artery; Surgery.

Introduction

The optimal treatment of renovascular hypertension (RVH) due to fibromuscular dysplasia is still unclear. Though angiography has largely replaced surgical reconstruction, there have been no randomised controlled trials to date comparing the two treatments. The aim of this study was to examine the long-term patency of renal artery bypass for fibromuscular dysplasia and its effect on hypertension.

Patients and Methods

Between January 1980 and December 1997 800 patients were operated on for renal artery disease. Of those, 101 (80 women, 21 men) with a mean age of 43 (16–74) years, were operated on for unilateral ($n=62$) or bilateral ($n=39$) fibromuscular disease (RFMD) in 140 kidneys (86 right, 54 left). The preoperative diagnosis was based on angiography (100 patients) and revealed unilateral ($n=33$) or bilateral ($n=23$) renal artery stenosis (RAS). Six patients had a unilateral renal artery occlusion (RAO) ($n=6$).

Eleven patients had renal artery aneurysms (RAA) on one ($n=9$) or both ($n=2$) sides. There was a combination of RAA and RAS in 28 patients with RAA and/or RAS on both sides in 13 cases with a high number of diseased segmental arteries (Table 1). Six patients had a solitary kidney because of contralateral nephrectomy elsewhere for the same disease at an earlier time. A renal artery dissection was found in 8 patients.

In 16 patients a late restenosis had developed at the site of a former percutaneous angioplasty (PTA) after a mean time of 25 months, and two patients were referred as emergencies for acute periprocedural RAO during PTA. Ninety-eight (97%) patients suffered from arterial hypertension, which required an average of two different drugs per day. The duration of this treatment for hypertension could not be retrieved from the hospital records. Thirty-seven (37%) patients were

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Table 1. Preoperative renal artery angiographical morphology in 101 patients.

	Patients	Kidneys	Arteries	
RAA	11	13	23	13/10*
RAS	58	81	89	84/5*
RAO	6	6	10	
RAA and RAS	26	40	67	39/28*
	101	140	189	

* Mainstem/segmental arteries.
RAA, Renal artery aneurysm; RAS, renal artery stenosis; RAO, renal artery occlusion.

Table 2. Methods of RAR in 101 patients – initial and secondary procedures.

	Initial procedures	Secondary procedures
Saphenous vein interposition	68	10
Resection and reanastomosis	21	
Dilatation with probes	17	
Saphenous vein bridging bypass	9	
Interposition of hypogastric artery	9	1
Aneurysm resection and direct suture	9	1
Splenic artery transposition	1	
Nephrectomy	1	
PTFE bypass		2
PTRA		1

smokers, 20 (20%) had a hyperlipidaemia, and five patients (5%) were diabetic. The preoperative mean creatinine was 1.0 ± 0.5 mg/100 ml. The creatinine exceeded 1.3 mg/100 ml in seven cases, and was greater than 2 mg/100 ml in two cases (5 and 6.7 mg/100 ml). No patient was dependent on dialysis.

The decision to perform surgery was taken after discussion with nephrologists, interventional radiologists, and vascular surgeons. For renal artery reconstruction a variety of techniques exclusively using autologous material were applied (Table 2). Aortorenal vein grafting was performed in the majority of cases. Primary nephrectomy was performed in one patient.

Patients' records were retrospectively reviewed for preoperative data, operative procedures and the postoperative course. All living patients were invited for an interview about their further course after operation, present blood pressure and antihypertensive medication, and measurement of creatinine and urea level in serum. Arterial hypertension was said to be cured if the diastolic blood pressure was below 90 mm mercury without antihypertensive medication. Hypertension was said to be improved if either the blood pressure was normal with less antihypertensive drugs than before operation or diastolic blood pressure was reduced below 90 mm mercury with the same number of drugs.

Patency was assessed by means of a duplex scanner using a 3.5 MHz transducer (Aloka). Colour imaging was used for vessel localisation. Angle corrected velocities were measured throughout the length of the renal artery. RAS was said to present if blood velocity exceeded 150 cm/s. In these cases, and in cases of doubt, angiography was performed. RAR occlusion was diagnosed if no signal could be identified in the relevant kidney and the renal artery could not be identified.

Patency rates were calculated according to Kaplan–Meier. Statistical analysis was performed using SPSS 9.0 and Chi-square test for categorical variables. Statistical significance was assumed if P was <0.05.

Results

Five patients had to be reoperated on for early graft occlusion (four) or severe stenosis (one). One patient died of septic bleedinng from an infected venous bilateral graft and one of severe pancreatitis, within 30 days of surgery, giving an early 30-day operative mortality of 2%. There were nonfatal complications in 12 patients (12%): bleeding, requiring reoperation in three patients, temporary renal insufficiency in seven, necessitating temporary dialysis in one patient. One patient developed postoperative ilio-femoral venous thrombosis with pulmonary embolism.

Postoperative angiography was obtained in 90 patients prior to discharge. Nine patients with good clinical results either refused to undergo angiography or did not have the angiography performed for logistic reasons. Patent renal arteries were demonstrated in 81 angiographically controlled patients (90%). There was a renal artery mainstem occlusion in five and a segmental artery occlusion in four cases. In these nine patients the primary method of repair had been saphenous vein bypass and intraoperative dilatation with probes in seven and two cases, respectively. All patients with mainstem occlusion had undergone an unsuccessful revision for early RAS or graft occlusion. Postoperative renal scintigraphy in three patients, who did not have a postoperative angiography, showed good renal function of both kidneys in two cases and a silent kidney in one. The histological workup in 89 cases revealed a disease of the media layer in 54, the perimedia layer in 7, and the intimal layer in four. A histological classification was not possible in 24 cases.

Late Results

There were no further deaths on follow-up. At a mean of 5.5 years (range 0.5 to 17.2) we obtained information

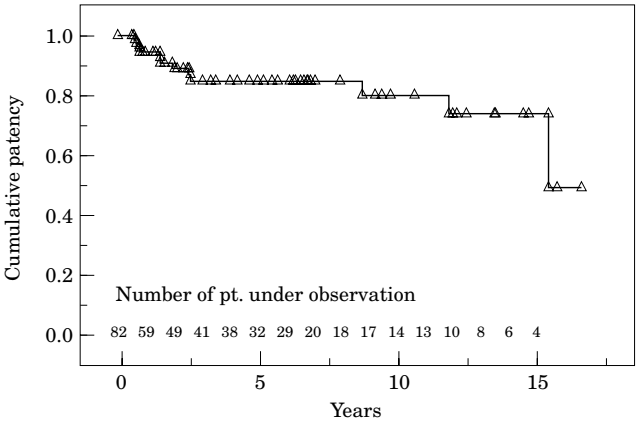

Fig. 1. Cumulative secondary patency after surgical reconstruction for RFMD according to Kaplan–Meier. Numbers below grafts are patients at risk. Standard error exceeds 5% after 8.7 years.

as to blood pressure, antihypertensive medication and creatinine levels in 92 patients. Seven patients were lost to follow-up. In 82 patients renal arteries could be examined by duplex scan and/or angiography. This revealed a restenosis (16) or occlusion (four) in 20 patients, which results in a 74% cumulative primary patency after 5 years. In one patient the concerned kidney was removed 5 years after RAR for a tumour. After a mean time of 33 months a second operation was performed in 15 patients for restenosis resulting in a cumulative secondary patency rate of 85% after 5 years (Fig. 1).

The preceding RAR before restenosis or occlusion had been saphenous vein bypass (12), transaortic dilatation (two), and renal artery resection (one). In all but two of these 15 patients hypertension had reoccurred or was impaired within 2 years after primary RAR, in eight patients within 1 year. The secondary RAR is shown in Table 2. In five cases of re-stenosis after primary saphenous vein bypass the stenosis was localised at the proximal anastomosis, which had been performed end to end with the proximal part of the renal artery. At the primary reconstruction this part of the renal artery seemed to be free of FMD.

Cure of hypertension was achieved in 24 (26%) and improvement of hypertension in 24 (26%) of the 92 patients, in whom we could obtain further information. In patients with patent renal arteries, hypertension was cured in 22 (36%) and improved in 19 (31%). Rate of cure was independent of the patient's age.

One female patient with bilateral renal artery disease developed dialysis dependent renal insufficiency after bilateral saphenous vein bypass. In all the other patients mean creatinine level remained unchanged, which was 1.0 ± 0.4 mg/100 ml at the time of re-examination as compared to the preoperative values with the exception of the two patients with a creatinine above 2 mg/100 ml preoperatively, who had normal creatinine levels thereafter.

Discussion

Despite a secondary patency of 85% at 5 years, there was a disappointingly low cure (36%) or improvement (31%) of hypertension. However, these results are similar to previously published data.[1–4] In one study[5] an outstanding high rate of primary technical success (98.8%) and long-term cure and improvement of hypertension of 73.6% and 22.6% was achieved. However, cure and improvement was not clearly defined. The high mean age of the patients operated on suggests that renovascular hypertension (RVH) may have been present for many years. This may have led to arteriolosclerosis causing renoparenchymatous hypertension, which cannot be reversed even after successful RAR. Indeed the mean age of patients operated on for RVH caused by RFMD nowadays is higher than in earlier time periods, when rates of cure of hypertension were better.[6–12] Although there was no statistical significance in our series the rate of cure of hypertension tended to be better in patients aged 45 years or younger. A reason for the delay of definite surgical RAR might be that renal artery percutaneous transluminal angioplasty (RPTA) nowadays is considered the preferable instrument of treatment. In our series 18 patients had undergone PTRA at least once before surgical RAR. Furthermore, new drugs for the medical treatment of hypertension may have led to a postponement of surgery.

PTRA has been recommended as initial treatment of choice in patients with RFMD and RVH (13), rendering a technical success between 86 and 100%.[14–17] Rates of cure and improvement of hypertension range between 22 and 39% and 43 and 63%, respectively. Rates of restenosis are between 7 and 27%.[15–18] The rather good results after PTRA in comparison with surgical reconstruction may be explained by morphological criteria used for selection of either surgery or balloon dilatation.

Surgeons who are experienced in RAR after RPTA for restenosis or for acute complications during RPTA recommended that RPTA should only be applied in short renal artery mainstem stenosis due to medial fibroplasia, and only if the RA bifurcation and segmental arteries are not diseased.[3,19–22] These principles are nowadays often neglected. As surgical RAR in our material was applied in all types of segmental artery disease, concomitant RAA or restenosis after PTA, the

rather disappointing results compared to the earlier literature can be explained easily. However, earlier surgical reconstruction can avoid secondary damage to the small renal intraparenchymal arteries and intrarenal arteriolar nephrosclerosis, and with the application of appropriate surgical techniques to the morphology and extension of the disease the cure rate of hypertension can be substantially improved. On the other hand we must admit that the presence of uni- or bilateral fibromuscular dysplasia does not necessarily mean that the hypertension is caused by the RAS within the dysplasia. One can assume that an unknown percentage of our patients suffered from primary hypertension although RFMD was present and successful reconstruction was achieved. In the future more precise methods for proper selection of the patients concerning the expectation of cure/improvement of hypertension and a more thorough preoperative workup are warranted.

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